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REPLACEMENT ABSTRACT

Please replace any previous abstract with this one:

An apparatus and method for monitoring the force severity of a mechanical press is able to do so without utilizing a contact force sensor. The method continually computes values of dynamic deflection for the press being monitored and utilizes these values to compute load on the press at any point in time. Also provided is a method and apparatus for generating a theoretical slide displacement curve and an actual displacement curve as well as a system for comparing such curves.

value of load on the press may be continually computed during press operation so that a load vs. time curve may be generated.

Please replace page 19, paragraph 1, line 9 with the following:

Fig. 3 graphically depicts four load vs. time curves for different press applications. As depicted in Fig. 3, different press applications may have the same peak compressive load (L1) and yet have very different impulse energy values. The value of utilizing impulse energy as an indicator of press performance is outlined in pending U.S. Provisional Patent Application Serial No. 60/159,818, the disclosure of which is herein explicitly incorporated by reference. Since impulse energy provides a reliable indicator of press operating condition, it is advantageous that the current invention can continually compute values of load during press operation. Fig. 5A graphically depicts a superimposed actual slide displacement curve with a theoretical no load slide displacement curve as well as a force vs. slide position curve generated by the method and apparatus of the current invention. Computational device 12 may be communicatively connected to a visual display device, an alert signal, press shutoff signal or a digital storage device which will store historical data for the press being monitored. Computational device 12 may further be connected to a modem or otherwise to a remote source where press operational condition may be usefully communicated.

this response and thus submit that that reference is not currently pertinent to the examination of the application. As such, Applicants have not provided copies of that reference herewith.

Responsive to the objection to the drawings as failing to comply with 37 CFR § 1.84(p)(5) Applicants have submitted a Request for Approval of Drawing Changes herewith, keeping in mind the comments offered by the Examiner. Applicants submit that the drawings are now in allowable form and hereby respectfully request that the objection thereto be withdrawn.

Responsive to the objection to the abstract of the disclosure as being less than the required length of fifty words, Applicants have submitted a replacement abstract herewith, keeping in mind the comments offered by the Examiner. Applicants submit that the new abstract is now in allowable form and hereby respectfully request that the objection thereto be withdrawn.

Responsive to the objection to the disclosure on the basis of an informality, Applicants have amended page 19, lines 8-9, keeping in mind the comments offered by the Examiner. Applicants submit that the disclosure is now in allowable form and hereby respectfully request that the objection thereto be withdrawn.

Responsive to the rejection of claims 1-4, 6, 11, 20-24, and 26 under 35 USC § 112, first paragraph, Applicants hereby respectfully traverse this rejection. The Examiner contends that the limitation of providing/storing an equation which can be used for generating a theoretical slide displacement curve based upon the press speed and a plurality of variables corresponding to characteristics of the press is not sufficiently enabled by the specification as the equation is not specifically provided for in this specification. Furthermore, the Examiner contends that the specification fails to describe to one of ordinary skill in the art the relationship between the variables and the slide displacement and/or the nature of which variables can be represented by values in order to determine the slide displacement curve.

However, in rejecting claims 1 and 3 under 35 USC § 103 (a), Applicant relies on Schockman '935, in part, on the basis that, quoting the Examiner, "It is considered inherent that some type of equation or formula must be used to translate the variable information into the load and displacement curves." Therefore, by the Examiner's own admission, one of ordinary skill in the art would know or know how to determine such an equation (otherwise the inherency argument would be improper).

Additionally, in an effort to supply the Examiner with necessary information to help overcome this rejection, Applicants hereby respectfully cite under 37 CFR § 1.105 two other patents assigned to the Minster Machine Company, U.S. Patent Number 6,453,806 (Bornhorst et al) and U.S. Patent Number 6,311,612 (Oen) (copies of both of which are enclosed herewith). Figure 2 of Bornhorst et al discloses both a slide motion curve that is typical for a majority of mechanical presses as well as an alternate slide motion curve in which the dwell of the slide is maintained longer at bottom dead center. Bornhorst et al further indicates that other times and locations of dwell may also be created (i.e., a change in press variables would thereby result in a change in the curve produced). Oen '612 discloses a link adjustment member that is capable of altering the drive mechanism of the mechanical press and the corresponding displacement curve produced thereby (Fig. 10). In Fig. 10, the plots indicate how a change in link position (i.e., from 89 degrees to 101.5 degrees as shown in the figure) will cause a change in the displacement curve produced. Such examples from Bornhorst et al and Oen indicate that one of ordinary skill in the art would understand that, for a given set of press variables, that a press should produce a characteristic displacement curve for that given set of press variables and that consequently, there would inherently

exist at least one equation for a given press type that could be used to at least approximate the displacement curve generated, thereby, each such equation taking into account certain press variables such as link position and/or press speed.

Therefore, based on the foregoing reasons, Applicants submit that claims 1, 3, 6, 20, and 26 do sufficiently describe to one of ordinary skill in the art the method of using the instant invention and hereby respectfully request that the rejection of claims 1-4, 6, 11, 20-24, and 26 under 35 USC § 112, first paragraph, be withdrawn.

Responsive to the rejection of claims 1 and 3 under 35 USC § 103 (a) as being unpatentable over U.S. Patent Number Re. 34,559 (Mickowski) in view of U.S. Patent Number 5,182,935 (Schockman), Applicants respectfully traverse this rejection and submit that claims 1 and 3 are now in condition for allowance.

Claim 1 recites in part:

> [a] method of generating a theoretical slide displacement curve for a mechanical press, comprising:
> ...
>
> plotting the calculated distance above bottom dead center values vs. time.

Applicant submit that such an invention is neither taught, disclosed, nor suggested by any of the cited references, alone or in combination.

Mickowski discloses graphically displaying the data corresponding to pressure and velocity associated with a ram of a press as a function of the incremental position of the ram along the stroke length thereof (column 2, lines 42-45). Mickowski further discloses that a profile can be generated corresponding to velocity versus position as well as velocity versus time or a combination of both. However, Mickowski does not disclose or suggest plotting the position of the ram versus time and/or crank angle. As such, the profiles or curves generated by Mickowski are not slide displacement curves in the manner as set forth with respect to the present invention. Accordingly, Mickowski fails to teach or suggest the present invention as set forth in claim 1.

Schockman does disclose the plotting of slide displacement versus crank angle for both slides of a double action press. Yet, there is no motivation to combine Schockman with Mickowski. Specifically, Schockman provides no reason for Mickowski to plot the slide or ram position of Mickowski versus crank angle or time instead of velocity or pressure, as set forth in Mickowski.

The primary principle of operation of Mickowski is to generate profiles which include one of pressure and velocity as a function of one of stroke length and time. To modify Mickowski to instead generate a plot of ram position versus time or crank

angle would change the principle of operation of the primary reference Mickowski (MPEP 2143.01). Additionally, the proposed modification would render Mickowski unsatisfactory for its intended purpose of generating profiles featuring velocity or pressure as one of the plotted variables (MPEP 2143.01). Therefore, it would not have been obvious to one of ordinary skill in the art to modify Mickowski with Schockman.

For all the foregoing reasons, Applicants submit that claim 1 is now in condition for allowance and hereby respectfully request that the rejection thereof based upon Mickowski in view of Schockman be withdrawn.

Claim 3 recites in part:

> [a]n apparatus for generating a theoretical slide displacement curve for a mechanical press, comprising: ...
>
> storage means for storing an equation which can be used for generating the theoretical slide displacement curve... ; and
>
> computer processor means for generating the theoretical slide displacement curve...

Applicant submit that such an invention is neither taught, disclosed, nor suggested by any of the cited references, alone or in combination. For essentially those reasons set forth with respect to claim 1, Applicant submit that the combination of Mickowski in view of Schockman does not disclose or suggest an

apparatus for generating a theoretical slide displacement curve. Thus, Applicants submit that claim 3 is in condition for allowance and hereby respectfully request that the rejection thereof based upon Mickowski in view of Schockman be withdrawn.

Claims 2 and 4 are rejected under 35 USC § 103 (a) as being unpatentable over Mickowski in view of Schockman and further in view of U.S. Patent Number 5,099,731 (Eigenmann). Claim 2 depends from claim 1, and claim 4 depends from claim 3. Since claims 1 and 3 are in condition for allowance as set forth above, Applicants submit that claims 2 and 4 are also in condition for allowance, the allowance of which is hereby respectfully requested.

Responsive to the rejections of claims 5, 7-10, 20, 21, 23, and 24 under 35 USC § 103 (a) as being unpatentable over Mickowski in view of Schockman and further in view of U.S. Patent Number 5,113,756 (Fujii) and U.S. Patent Number 5,555,757 (Smith et al). Applicant hereby respectfully traverses this rejection and submits that claims 5, 7-10, 20, 21, 23, and 24 are in condition for allowance.

Claim 5 recites, in part:

> generating a theoretical no load slide displacement curve for the press...

Likewise, claim 20 recites, in part:

> storage means for storing an equation which can be used for generating the theoretical slide displacement curve...;
>
> a computational device for generating the theoretical slide displacement curve...

Applicants submit that such an invention as set forth in each of claims 5 and 20 is neither taught, disclosed, nor suggested by any of the cited references, alone or in combination.

For the reasons set forth above, the combination of Mickowski in view of Schockman fails to teach or suggest the generation of a theoretical slide displacement curve, when considering those references in combination. Accordingly, Mickowski in view of Schockman fails to teach or suggest the present invention as set forth in each of claims 5 and 20.

Fujii discloses a press machine which has the ability to adjust the "die height" based upon a position readout given by a bottom dead point position detecting means. Fujii does not disclose or suggest plotting any sort of position data relative to another variable associated with the press operation. Thus, Fujii fails to teach or suggest the present invention, as set forth in each of claims 5 and 20, and fails to overcome the shortcomings of the combination of Mickowski in view of Schockman.

Smith et al does disclose the plotting of slide displacement versus the angular displacement of the slide of the press. Yet in much the same manner as Scockman, Smith fails to provide motivation for plotting position versus angle instead of pressure or velocity as set forth in Mickowski. As the plotting of pressure and/or velocity appears to be critical to the principle of operation of Mickowski and since Smith et al provides no compelling reason to replace the plotting of at least one of pressure and velocity with another variable such as time or crank angle, Applicants submit that it would not have been obvious to one of ordinary skill in the art to modify Mickowski with Smith et al, and that Smith et al fails to overcome the shortcomings of Mickowski.

Furthermore, as set forth in our previous response mailed August 22, 2002, the Examiner admits that Mickowski and Schockman fail to teach the steps of determining the contact point on the actual slide displacement curve which corresponds to the slide contacting the stock material, establishing a start point on the slide down stroke between top dead center and the contact point, and establishing an end point on the slide upstroke between top dead center and the contact point.

The Examiner asserts that Fujii teaches a method for determining and adjusting the die height of a press machine that includes the provision of a non-contact sensor used to indicate

contact between the slider and the bottom dead position of the press as well as the contact between the slider and the top dead position of the press. As set forth, in column 6, lines 9-31, thereof, Fujii provides a bottom dead point position detector 55 and a top dead point position detector 58, which together thereby allow detection of the slider when it reaches one of these points.

However, there is no provision of a detector that is capable of determining the position of the slider at any points intermediate the bottom dead point and the top dead point. As defined by the present specification, at contact point 60 the slide contacts the stock material (page 18, lines 10-15), contact point 60 thereby being intermediate the top dead center and the bottom dead center. Therefore, Fujii fails to teach or suggest the step of determining the contact point on the actual slide displacement curve, as set forth by the present invention as claimed in claims 5 and 20.

The Examiner relies upon Smith et al. as a disclosure of a slide drive system that reciprocates in response to the CAM rotation and for an accompanying diagram for illustrating the displacement curve for a slide in comparison with a reference displacement curve. Smith et al does not teach or suggest the establishment of a start point on the slide down stroke between top dead center and the contact point, nor does Smith et al teach

or suggest the establishment of an end point on the slide upstroke between the top dead center and the contact point.

Furthermore, Smith et al does not teach or suggest matching the actual slide displacement curve to the theoretical no load slide displacement curve for the same mechanical press. As seen from column 11, lines 11-14, Smith et al provides an acceleration curve for their invention and an acceleration curve for a typical prior art crank and pitman type thread roller (shown in dotted line form). As such, the acceleration curve of the invention is not compared to a theoretical acceleration curve for that invention. Therefore, Smith et al provides no reason or motivation to attempt to match the acceleration curve provided by the CAM and follower linkage drive of their invention with the acceleration curve provided in a typical prior art crank-and-pitman-type thread roller in a manner similar to that set forth for matching the theoretically displacement curve of the present invention. Thus, Smith et al. fail to teach or suggest the present invention as set forth in claims 5 and 20.

For all the foregoing reasons, Applicants submit that claim 5, and claims 7-10 depending therefrom; and claim 20, and claims 21, 23, and 24 depending therefrom, are now in condition for allowance and hereby respectfully request that the rejection thereof based upon Mickowski in view of Schockman and further in view of Fujii and Smith et al be withdrawn.

Claim 6 and 22 are rejected under 35 USC § 103 (a) as being unpatentable over Mickowski in view of Schockman, Fujii, Smith, and further in view of U.S. Patent Number 5,099,731 (Eigenmann). However, claim 6 depends from claim 5, and claim 22 depends from claim 20. Since claims 5 and 20 are now in condition for allowance for the reasons set forth above, Applicants submit that claim 6 and 22 are also in condition for allowance, the allowance of which is hereby respectfully requested.

Claims 13 and 16 stand rejected under 35 USC § 103 (a) as being unpatentable over Mickowski in view of Schockman, Eigenmann, Fujii, and Smith, and further in view of U.S. Patent Number 5,870,254 (Baserman et al). Applicant submits that claim 13, based upon its allowance upon allowable claim 5, this is in condition for allowance due to its dependency. Furthermore, Applicants hereby otherwise respectfully traverse the rejection of claims 13 and 16 and submit that these claims are allowable based upon their own merits.

The Examiner admits that Mickowski in combination with Shockman, Eigenmann, Fujii, and Smith et al fail to teach or suggest including a value of static stiffness with the other obtained press information and calculating the load on the press at any point of the slide stroke by multiplying the value of the dynamic deflection for the relevant point of the slide stroke by

the value of static stiffness. The Examiner relies on Baserman et al which discloses the determination of the amount of gram load loss due to the unbalanced lifting forces existing in the actuator arms in a computer disk drive system. One such means set forth by Basermann et al is to use finite element analysis to calculate the deflection and rotation of the arm tip when nominal lifting forces applied at the slider, each slider in this instance being one of transducer sliders 160-170. While Baserman et al does multiply deflection by vertical stiffness to determine the decrease in gram load, Baserman et al does not calculate the load at any point on a slide stroke of a mechanical press.

Moreover, the Baserman et al reference is not analagous art and is not used to solve the same problem as the present invention. The unbalanced forces being detected in relation to the disk drive of Baserman et al are on the order of a few grams, while those being detected with respect to the present invention are on the order of tons. Additionally, there is no disclosure or suggestion in Baserman et al that the decrease in gram load is to be determined at various points along the transducer slider.

For all the foregoing reasons, Applicants submit that claims 13 and 16 are in condition for allowance and respectfully request the withdrawal of the rejection thereof based upon the above-cited reference combination.

Claims 14, 15, 17-19, 25, and 26 were rejected under 35 U.S.C. 35 § 103(a) as being unpatentable over Mickowski in view of Shockman, Eigenmann, Fujii, Smith et al, and Baserman et al, and further in view of U.S. Patent No. 3,885,283 (Biondetti). Claims 14 and 15 depend from claim 5; and claims 17-19 depend from claim 16, claims 5 and 16 being in condition for allowance for reasons set forth above. Thus, Applicants submit that claims 14, 15, and 17-19 are also in condition for allowance, the allowance which is hereby respectfully requested. Further, applicants traverse the rejection of claims 25 and 26 and submit that those claims are also in condition for allowance.

Claim 25 recites in part:

> a computational device, said computational device communicatively connected to said speed sensor, said non-contact displacement sensor and said input means, said computational device computing a theoretical no load value of slide displacement, said computational device computing a value of dynamic deflection by computing the difference between the theoretical no load value and the corresponding actual load value of slide displacement, said computational device multiplying the value of dynamic deflection by the value of static stiffness of the mechanical press to determine a value of load on the press at a point of the slide stroke.

(Emphasis added.) Applicants submit that such an invention is neither taught, disclosed, or suggested by any of the cited references, alone or in combination.

The shortcomings of Mickowski, Shockman, Eigenmann, Fujii, Smith et al, and Baserman et al, with respect to the present

invention as set forth in claim 25 have been discussed previously, and Applicants submit those Biondetti does not overcome the shortcomings. For example, Biondetti does not disclose or suggest a non-contact displacement sensor for sensing slide displacement; and/or a computational device capable of computing a theoretical no-load value of slide displacement and/or capable of multiplying the value of dynamic deflection by the value of static stiffness of the mechanical press to determine a value of load on the press at a point of the side stroke, such as set forth by claim 25.

Biondetti does disclose that the amount of bending of a beam is a dynamic deflection value thereof. Yet, the reference does not disclose the step of multiplying the value of the dynamic deflection by the value of static stiffness of the mechanical press to determine a value of load on the press at a point of the slide stroke. Thus, Biondetti fails to teach or suggest the present invention as defined in claim 25.

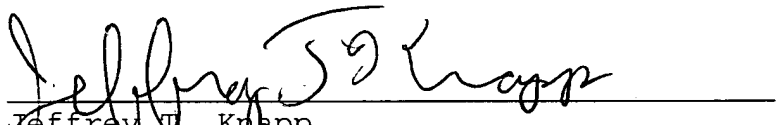
For all the foregoing reasons, Applicants submit that claim 25, and claim 26 depending therefrom, are now in condition for allowance and respectfully request that the rejection thereof under 35 USC § 103(a) be withdrawn.

Overall, it is submitted that none of the secondary references used in combination with Mickowski can sufficiently overcome the fact that it is critical to the principle of

operation of Mickowski that at least one of pressure and velocity of associated with a stroke be included in any profile plotted relative to the operation of the press of Mickowski. As such, the modification of Mickowski with the various cited secondary references in the manner in which those various combinations have been presented would not have been obvious to one of ordinary skill in the art at the time the invention was made.

If the Examiner has any questions or comments that would speed prosecution of this case, the Examiner is invited to call the undersigned at 260/485-6001.

Respectfully submitted,



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Encl.: Replacement Abstract
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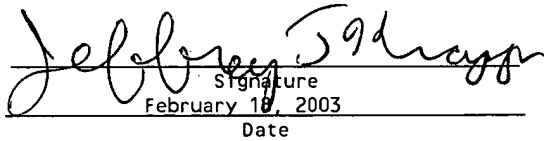

Signature
February 18, 2003
Date

MARKED-UP ABSTRACT

Please replace any previous abstract with this one:

An apparatus and method for monitoring the force severity of a mechanical press is able to do so without utilizing a contact force sensor. The method continually computes values of dynamic deflection for the press being monitored and utilizes these values to compute load on the press at any point in time. Also provided is a method and apparatus for generating a theoretical slide displacement curve and an actual displacement curve as well as a system for comparing such curves.

value of load on the press may be continually computed during press operation so that a load vs. time curve may be generated.

Please amend page 19, paragraph 1, line 9 as follows:

Fig. 3 graphically depicts four load vs. time curves for different press applications. As depicted in Fig. 3, different press applications may have the same peak compressive load (L1) and yet have very different impulse energy values. The value of utilizing impulse energy as an indicator of press performance is outlined in pending U.S. Provisional Patent Application Serial No. [, 60/15*9,818] 60/159,818, the disclosure of which is herein explicitly incorporated by reference. Since impulse energy provides a reliable indicator of press operating condition, it is advantageous that the current invention can continually compute values of load during press operation. Fig. 5A graphically depicts a superimposed actual slide displacement curve with a theoretical no load slide displacement curve as well as a force vs. slide position curve generated by the method and apparatus of the current invention. Computational device 12 may be communicatively connected to a visual display device, an alert signal, press shutoff signal or a digital storage device which will store historical data for the press being monitored. Computational device 12 may further be connected to a modem or otherwise to a remote source where press operational condition may be usefully communicated.